Science Field Review

October 2 – December 1, 2006

Functional Independence, Supported Independence, and Participation (FI/SI/P)

Extended Benchmarks (EB)

Background Information: The federal No Child Left Behind Act of 2001 mandated the existence of a set of comprehensive state assessments that are designed and based on rigorous content. The MI-Access Science Assessment Plan Writing Team (APWT) extended the Michigan Curriculum Framework's Science Content Benchmarks, 2000 version (MCF v.2000) for the Functional Independence, Supported Independence, and Participation (FI/SI/P) student populations during the 2005-2006 school year. The draft Extended Benchmarks (EB) require field review in order to ensure they are appropriate for each population.

Instructions: Please complete the online survey for the MI-Access FI/SI/P EB in order to provide the Michigan Department of Education your feedback. The survey is located at www.mi.gov/mi-access in the "Survey Information" category.

SCIENCE
USING PHYSICAL SCIENCE KNOWLEDGE

Extended Benchmarks
MI-Access Functional Independence, Supported Independence, and Participation

The science benchmarks in this document are taken from the Michigan Curriculum Framework Science Content Benchmarks, 2000 version (MCF v.2000). These benchmarks have been extended for the MI-Access Functional Independence, Supported Independence, and Participation populations, and are presented in this document. The coding key below explains abbreviations found in this document, including the benchmark and extended benchmark codes.

Table of Contents and Coding Key

Content Area: Science (S)
Level of Independence:
- Full Independence: These students would most likely participate in the Michigan Educational Assessment Program (MEAP) assessments with or without accommodations.
- MI-Access Population:
  - Functional Independence (FI)
  - Supported Independence (SI)
  - Participation (PA)

Strand: Using Physical Science Knowledge (P) [In MCF v.2000: IV]
Standard:

Grade Level:

- Elementary (e)
- Middle School (m)
- High School (h)

Extended Benchmark

- EB01, EB02, etc. [In MCF v.2000, Benchmark: 1, 2, etc.]

n/a = Not applicable

SCIENCE
STRAND: MATTER AND ENERGY (ME)

All students will measure and describe the things around us:

Level of Independence (Full, FI, SI, PA) and Assessable at: (Classroom / LEA / ISD, State)	**Grade Level**		
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	**IV.1.e.1** Classify common objects and substances according to observable attributes/properties. *Key concepts:* Texture—rough, smooth. Flexibility—rigid, stiff, firm, flexible, strong. Hardness. Smell—pleasant, unpleasant. States of matter—solid, liquid, gas. Magnetic properties—attract, repel, push, pull. Size—larger, smaller (K-2); length, width, height (3-5). Sink, float. Color—common color words. Shape—circle, square, triangle, rectangle, oval. Weight—heavy, light, heavier, lighter. See PWV-IV.4.e.4 (shadows: objects that let light pass through or block light); PME-IV.1 e.2 (materials that conduct electricity); C-I.1 e.4 (use measuring devices).	**IV.1.m.1** Describe and compare objects in terms of mass, volume, and density. *Key concepts:* Units of density—grams per cubic centimeter or grams per milliliter. *Measurement tools:* Balance, measuring cup or graduated cylinder, metric ruler. See C-I.1 m.4 (making measurements). *Real-world contexts:* Common objects and substances.	**IV.1.h.1** Analyze properties of common household and agricultural materials in terms of risk/benefit balance. *Key concepts:* Risk/benefit analysis. *Real-world contexts:* Herbicides, refrigerants, fertilizers, detergents.

	Real-world contexts: Common objects, such as desks, coins, pencils, buildings, snowflakes; common substances, including—solids, such as copper, iron, wood, plastic, Styrofoam; liquids, such as water, alcohol, milk, juice; gases such as air, helium, water vapor.		
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.ME.e.EB01** Classify common objects and substances according to observable attributes/properties. *Key concepts:* Texture—rough, smooth. Flexibility—rigid, stiff, firm, flexible, strong. Hardness. Smell—pleasant, unpleasant. States of matter—solid, liquid, gas. Magnetic properties—attract, repel, push, pull. Size—larger, smaller; length, width, height. Sink, float. Color—common color words. Shape—Circle, square, triangle, rectangle, oval. Weight—heavy, light, heavier, lighter. *Real-world contexts:* Common objects, such as desks, coins, pencils, buildings, snowflakes; common substances, including solids, such as copper, iron, wood, plastic, Styrofoam; liquids, such as water, alcohol, milk, juice; gases, such as air, helium, water vapor. Grocery shopping (bagging), road signs (colors).	**S.FI.P.ME.m.EB01** Describe and compare objects in terms of weight and width. *Key concepts:* Limit to standard measures; not metric. *Real-world contexts:* Measuring common objects and substances, such as personal weight, clothes sizes, furniture; grocery shopping; hanging pictures; building trades.	**S.FI.P.ME.h.EB01** Identify the uses of common household and agricultural materials in terms of risk/benefit balance. *Key concepts:* Risk/benefit analysis. *Real-world contexts:* Identifying warnings when using herbicides; refrigerants; fertilizers; cleaning products—detergents, household products; trade materials; medications.

Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.ME.e.EB01** Identify physical attributes/properties of objects. *Key concepts:* Texture—rough, smooth. Flexibility—rigid, stiff, firm, flexible, strong. Hardness. Smell—pleasant, unpleasant. States of matter—solid, liquid, gas. Size—larger, smaller; length, width, height. Sink, float. Color—common color words. Shape—Circle, square, triangle, rectangle, oval. Weight—heavy, light, heavier, lighter. *Real-world contexts:* Leisure activities (swimming, bowling), clothing choice, personal hygiene, carrying objects, environmental/safety signs.	**S.SI.P.ME.m.EB01** Identify and describe physical attributes/properties of objects. *Key concepts:* States of matter—solid, liquid, gas. Size—larger, smaller; width. Sink, float. Weight—heavy, light, heavier, lighter. *Real-world contexts:* Leisure activities (swimming, bowling), clothing choice, carrying objects.	**S.SI.P.ME.h.EB01** Identify and describe physical attributes/properties of objects. *Key concepts:* Texture—rough, smooth. Flexibility—rigid, stiff, firm, flexible, strong. Hardness. Smell—pleasant, unpleasant. States of matter—solid, liquid, gas. Size—larger, smaller; length, width, height. Sink, float. Color—common color words. Shape—Circle, square, triangle, rectangle, oval. Weight—heavy, light, heavier, lighter. *Real-world contexts:* Leisure activities (swimming, bowling), clothing choice, personal hygiene, carrying objects, environmental/safety signs.

Draft Participation Extended Benchmark Classroom/LEA/ISD and State	**S.PA.P.ME.e.EB01** Identify physical attributes/properties of objects. *Key concepts:* Texture—rough, smooth. Smell—pleasant, unpleasant. Size—larger, smaller. Color—common color words. Shape—circle, square, triangle. Weight—heavy, light. *Real-world contexts:* Leisure activities, clothing choice, personal hygiene, carrying objects, environmental signs, animals.	**S.PA.P.ME.m.EB01** Identify and describe physical attributes/properties of objects. *Key concept:* Size—larger, smaller. Sink, float. Weight—heavy, light, heavier, lighter. *Real-world contexts:* Leisure activities, clothing choice, carrying objects.	**S.PA.P.ME.h.EB01** Identify and describe physical attributes/properties of objects. *Key concepts:* Texture—rough, smooth. Flexibility—rigid, stiff, firm, flexible, strong. Hardness. Smell—pleasant, unpleasant. States of matter—solid, liquid. Size—larger, smaller; length, width, height. Sink, float. Color—common color words. Shape—circle, square, triangle, rectangle, oval. Weight—heavy, light, heavier, lighter. *Real-world contexts:* Leisure activities, clothing choice, personal hygiene, carrying objects, environmental signs.

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.1.e.2** Identify properties of materials which make them useful. *Key concepts:* Useful properties—unbreakable, water-proof, light-weight, conducts electricity (see PME-IV.1 e.4, electric circuits), conducts heat, attracted to a magnet, clear. See EG-V.1 e.4 (uses of earth materials). *Real-world contexts:* Appropriate selection of materials for a particular use, such as waterproof raincoat, cotton or wool for clothing, glass for windows, metal pan to conduct heat, copper wire to conduct electricity.	**IV.1.m.2** Explain when length, mass, weight, density, area, volume or temperature are appropriate to describe the properties of an object or substance. *Key concepts:* Appropriate metric (s.i.) units. See C-I.1 m.4 (use measuring devices). *Measurement tools:* Balances, spring scales, measuring cups or graduated cylinders, thermometers, metric ruler. *Real-world contexts:* Common substances such as those listed in PME-IV.1 e.1; hot and cold substances, such as ice, snow, cold water, hot water, steam, cold air, hot air.	**IV.1.h.2** Identify properties of common families of elements. *Key concepts:* Properties—state, reactivity, metal/non-metal, conductivity. *Tools*: Various element samples. *Real-world contexts:* Highly reactive metals (such as potassium, sodium), less-reactive metals (such as calcium), highly reactive nonmetals (such as chlorine, fluorine, and oxygen), almost completely non-reactive gases (such as helium and neon); relationships on the Periodic Table of Elements.

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.ME.e.EB02** Identify properties of materials that make them useful. *Key concepts:* Useful properties—unbreakable, waterproof, lightweight, conducts heat. *Real-world contexts:* Appropriate selection of materials for a particular use, such as clothing selection, energy conservation, and cooking (waterproof raincoat, cotton or wool for clothing, glass for windows, metal pan to conduct heat).	**S.FI.P.ME.m.EB02** Identify when length, weight, area, volume, or temperature is appropriate to describe the properties of an object or substance. *Key concepts:* Appropriate standard units. *Real-world contexts:* Measurement of ice, snow, hot water, classroom dimensions, soda pop volume. Also, appropriate measurements for use in clothing selection, cooking, shopping, restaurants and food services.	n/a
Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.ME.e.EB02** Identify how materials are useful. *Key concepts:* Useful properties—unbreakable, waterproof, lightweight. *Real-world contexts:* Raincoat, rubber boots, flotation device.	**S.SI.P.ME.m.EB03** Identify when weight, length, and temperature are appropriate to describe an object. *Key concepts:* Temperature, size (measured to the inch), heavy/light. *Real-world contexts:* Seasons, clothing, food (preparation, storage, serving), health (weight, height), cleansing with appropriate water.	n/a

Draft Participation Extended Benchmark Classroom/LEA/ISD	**S.PA.P.ME.e.EB02** Identify how materials are useful. *Key concepts:* Useful properties—waterproof, lightweight. *Real-world contexts:* Raincoat, rubber boots, flotation device.	**S.PA.P.ME.m.EB02** Explore activities to show how materials are useful. *Key concepts:* Useful properties—unbreakable, waterproof, lightweight, conducts heat. *Real-world contexts:* Raincoat, rubber boots, flotation device, heading pad, cooking and food preparation (pan is hot), indicating texture/temperature preference.	n/a

All students will explain what the world around us is made of:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	None	**IV.1.m.3** Classify substances as elements, compounds, or mixtures, and justify classifications in terms of atoms and molecules. *Key concepts:* Element, compound, mixture, molecule, atom. See PME-IV.1 m.4 (molecular structure of solids, liquids and gases). *Real-world contexts:* Common substances such as those listed above, including—elements, such as copper, aluminum, sulfur, helium, iron; compounds, such as water, salt, sugar, carbon dioxide; mixtures, such as soil, salt and pepper, salt water, air.	**IV.1.h.3** Explain how elements differ, in terms of the structural parts and electrical charges of atoms. *Key concepts:* Parts of atoms—nucleus, electron cloud. Subatomic particles—proton, neutron, electron. Electrical charges—positive, negative, neutral. Each element has a unique number of protons. See PMO-IV.3 m.3 (electric force). *Real-world contexts:* All elements.
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.ME.e.EB0A** Identify mixtures or components of mixtures. *Key concepts:* Solid, liquid, mixture. *Real-world contexts:* Powdered drink, chocolate mix and liquid, mixture (trail mix, salad), gelatin.	**S.FI.P.ME.m.EB03** Recognize that all items are made of smaller particles. *Key concepts:* Element, compound, mixture, molecule, atom. *Real-world contexts:* Items such as water, salt, and carbon dioxide. In cooking, powdered drink mix.	**S.FI.P.ME.h.EB02** Identify the structural parts and electrical charges of atoms. *Key concepts:* Parts of atoms—nucleus, electron cloud. Subatomic particles—proton, neutron, electron. Electrical charges—positive, negative, neutral. *Real-world contexts:* All elements. For example, charging batteries in automobiles, replacing batteries.

Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.ME.e.EB03** Identify mixtures or components of mixtures. *Key concepts:* Solid, liquid, mixture. *Real-world contexts:* Powdered drink, chocolate mix and liquid, mixture (trail mix, salad), gelatin.	**S.SI.P.ME.m.EB04** Identify mixtures or components of mixtures. *Key concepts:* Solid, liquid, mixture, dissolve. *Real-world contexts:* Powdered drink, chocolate mix and liquid, mixture (trail mix, salad), gelatin.	**S.SI.P.ME.h.EB03** Identify materials (solids and liquids) that when mixed together form a new product (mixture/solution). *Key concepts:* Solid, liquid, mixture, dissolve, solution. *Real-world contexts:* Powdered drink, chocolate mix and liquid, mixture (trail mix, salad), gelatin, cleansing solutions, fertilizers.
Draft Participation Extended Benchmark Classroom/LEA/ISD and State	n/a	**S.PA.P.ME.m.EB03** Identify mixtures or components of mixtures. *Key concepts:* Solid, liquid, mixture. *Real-world contexts:* Powdered drink, chocolate mix and liquid, mixture (trail mix, salad), gelatin.	**S.PA.P.ME.h.EB03** Identify mixtures or components of mixtures. *Key concepts:* Solid, liquid, mixture. *Real-world contexts:* Powdered drink, chocolate mix and liquid, mixture (trail mix, salad), gelatin.

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	None	**IV.1.m.4** Describe the arrangement and motion of molecules in solids, liquids, and gases. *Key concepts:* Arrangement—regular pattern, random. Distance between molecules—closely packed, separated. Molecular motion—vibrating, bumping together, moving freely. (PCM-IV.2 m.4 addresses the molecular explanations of changes of state.) *Real-world contexts:* Common solids, liquids, and gases, such as those listed above.	None
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	n/a	n/a	**S.FI.P.ME.h.EB03** Describe the arrangement and motion of molecules in solids, liquids, and gases. *Key concepts:* Arrangement—regular pattern, random. Distance between molecules—closely packed, separated. Molecular motion—vibrating, bumping together, moving freely. *Real-world contexts:* Common solids vs. liquids, such as in cooking—boiling water, freezing materials; expansions—roads, bridges.

Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			
All students will identify and describe forms of energy:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	**IV.1.e.3** Identify forms of energy associated with common phenomena. *Key concepts:* Heat, light, sound, food energy, energy of motion, electricity (see PCM-IV.2 e.1 about heat, PWV-IV.4 e.1-4 about light and sound, PME IV.1 e.4 about electricity, LEC-III.5 e.2 about energy from food). *Real-world contexts:* Appropriate selection of energy and phenomena, such as appliances like a toaster or iron that use electricity, sun's heat to melt chocolate, water wheels, wind-up toys, warmth of sun on skin, windmills, music from guitar, simple electrical circuits with batteries, bulbs and bells.	None	None

Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

All students will explain how electricity and magnetism (see Motion of Objects) interact with matter:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	**IV.1.e.4** Construct simple, useful electrical circuits. *Key concepts and tools:* Complete loop; batteries, bulbs, bells, motors, wires, electrical switches (see PME-IV.1 e.2, materials that conduct electricity). *Real-world contexts:* Flashlights, battery-powered toys.	**IV.1.m.5** Construct simple circuits and explain how they work in terms of the flow of current. *Key concepts and tools:* Complete circuit, incomplete circuit, short circuit, current, conductors, nonconductors, batteries, household current, bulbs, bells, motors, electrical switches. *Real-world contexts:* Household wiring, electrical conductivity testing, electric appliances.	**IV.1.h.4** Explain how current is controlled in simple series and parallel circuits. *Key concepts:* Single path, multiple paths, switches, fuses, circuit breakers, power supply, batteries, household current, motors, bulbs, circuit diagrams. *Real-world contexts:* Basic household wiring, automobile wiring, flashlights, tree lights, power lines; electrical conductivity testing.
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.ME.e.EB03** Identify and construct simple, useful electrical circuits. *Key concepts/Tools:* Complete loop; batteries, bulbs, bells, motors, wires, electrical switches. *Real-world contexts:* Replacing light bulbs and batteries in flashlights and battery-powered toys.	**S.FI.P.ME.m.EB04** Construct simple circuits and identify how they work in terms of the flow of current. *Key concepts:* Complete circuit, incomplete circuit (open, closed), current, conductors, non-conductors, batteries, bulbs, bells, electrical switches, electrical appliances, and electrical toys. *Real-world contexts:* Using household appliances, household wiring, electric appliances; electrical conductivity testing; trades—automotive, HVAC, building trades, computers.	**S.FI.P.ME.h.EB04** Explore how current is controlled in simple and parallel circuits. *Key concepts:* Single path, multiple paths, switches, fuses, circuit breakers, power supply, batteries, household current, motors, bulbs, circuit diagrams. *Real-world contexts:* Using household appliances, basic household wiring, flashlights, tree lights, power lines, automotive wiring; electrical conductivity testing; trades—automotive, HVAC, building trades, computers.

Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.ME.e.EB04** Identify and use electrical circuits. *Key concepts:* Electric, non-electric, battery-operated, non-battery-operated. *Real-world contexts:* Tape recorder, battery-powered toys and gadgets, recordable switches.	**S.SI.P.ME.m.EB05** Identify useful electrical circuits. *Key concepts:* Open and closed circuits, complete, incomplete. *Real-world contexts:* Recognizing and requesting need to charge/change batteries and electrical devices (cooking, hearing aids, wheelchairs, tape recorders, light bulbs).	**S.SI.P.ME.h.EB04** Identify useful electrical circuits. *Key concepts:* Open and closed circuits, complete, incomplete, switch/power supply. *Real-world contexts:* Recognizing and requesting need to charge/change batteries and electrical devices (cooking, hearing aids, wheelchairs, tape recorders, light bulbs); labeling and proper use of items associated with electricity (outlet, cords, switches).
Draft Participation Extended Benchmark Classroom/LEA/ISD and State	**S.PA.P.ME.e.EB03** Identify parts of electrical circuits in common activities. *Key concepts:* Switches. *Real-world contexts:* Operating switch, tape recorder, battery-powered toys and gadgets, recordable switches, lights on/off, wheelchairs, communication.	**S.PA.P.ME.m.EB04** Operate useful electrical circuits. *Key concepts:* Switches. *Real-world contexts:* Operating switch, tape recorder, battery-powered toys and gadgets, recordable switches, lights on/off, wheelchairs, communication.	**S.PA.P.ME.h.EB04** Identify and use electrical circuits. *Key concepts:* Electric, non-electric, battery-operated, non-battery-operated. *Real-world contexts:* Tape recorder, battery-powered toys and gadgets, recordable switches, wheelchairs, communication.

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.1.e.5** Describe possible electrical hazards to be avoided at home and at school. *Key concepts:* Shock, wall outlet, hazards; see PMEIV.1 e.3 (electrical energy). *Real-world contexts:* Electric outlets, power lines, frayed electric cords, electric appliances, lightning, hair dryers in sinks and tubs.	**IV.1.m.6** Investigate electrical devices and explain how they work, using instructions and appropriate safety precautions. *Key concepts:* Flow of electricity for energy or information transfer. Safety precautions for using electrical appliances; grounding. Documentation for toys and appliances—wiring diagrams, written instructions. (See PCM-IV.2 m.3, transformations of energy.) *Real-world contexts:* Situations requiring assembly, use, or repair of electrical toys, radios, or simple appliances, such as replacing batteries and bulbs; connecting electrical appliances, such as stereo systems, TV's and videocassette recorders, computers and computer components.	**IV.1.h.5** Describe how electric currents can be produced by interacting wires and magnets, and explain applications of this principle. *Key concepts:* Current flow and direction, magnetic fields. See PMO-IV.3 m.4 (magnetism from electricity). *Real-world contexts:* Generators, alternating current, direct current.

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.ME.e.EB04** Identify possible electrical hazards to be avoided at home and at school. *Key concepts:* Shock, power line, electric outlet, electric appliances, lightning, hazards. *Real-world contexts:* Safety in storms (lightning, power lines); safety in the house (electric outlets, frayed electric cords, safe use of electric appliances (hair dryer in sink/tub, knife in toaster).	**S.FI.P.ME.m.EB05** Investigate electrical devices, using instructions and appropriate safety precautions. *Key concepts:* Safety precautions for using electrical appliances; grounding. *Real-world contexts:* Situations requiring use of simple appliances, such as replacing light bulbs/batteries; following instructional manuals; hooking up appliances.	**S.FI.P.ME.h.EB05** Identify/state safety rules/precautions related to common household appliances that use electric motors. *Key concepts:* Safety precautions for using electrical appliances; grounding. *Real-world contexts:* Situations requiring the use of simple appliances; use of electricity and water, grounding; rules and regulations concerning careers in electrical and building trades.
Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.ME.e.EB05** Identify possible electrical hazards to be avoided at home and at school. *Key concepts:* Shock, power line, electric outlet, electric appliances, lightning. *Real-world contexts:* Safety in storms, safety in the house (hair dryer in sink/tub, knife in toaster, finger in outlet).	**S.SI.P.ME.m.EB06** Use instructions and appropriate safety precautions with electrical devices. *Key concepts:* Shock, power line, electric outlet, electric appliances, lightning. *Real-world contexts:* Safety in storms, safety in the house (hair dryer in sink/tub, knife in toaster, finger in outlet); electric appliances (household); replacing light bulbs/batteries.	**S.SI.P.ME.h.EB05** Use instructions and appropriate safety precautions with devices that use electric motors. *Key concepts:* Shock, power line, electric outlet, electric appliances, lightning. *Real-world contexts:* Safety in storms, safety in the house (hair dryer in sink/tub, knife in toaster, finger in outlet); electric appliances (household); replacing light bulbs/batteries.
Draft Participation Extended Benchmark			

SCIENCE
STRAND: CHANGES IN MATTER (CM)

All students will investigate, describe and analyze ways in which matter changes:

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.2.e.1** Describe common physical changes in matter—size, shape; melting, freezing (K-2); dissolving, evaporating (3-5). *Key concepts:* States of matter—solid, liquid, gas. Changes in size and shape—bending, tearing, breaking. Processes that cause changes of state: heating, cooling. See EH-V.2 e.1 (water in three states). *Real-world contexts:* Changes in size or shape of familiar objects, such as making snowballs, breaking glass, crumbling cookies, making clay models, carving wood, breaking bones; changes in state of water or other substances, such as freezing of ice cream, or ponds, melting wax or steel, puddles drying up.	**IV.2.m.1** Describe common physical changes in matter: evaporation, condensation, sublimation, thermal expansion and contraction. *Key concepts:* States of matter—solid, liquid, gas. Processes that cause changes of state or thermal effects: heating, cooling. Boiling. Mass/weight remains constant during physical changes in closed systems. *Real-world contexts:* States of matter—solid, liquid, gas. Changes in state, such as water evaporating as clothes dry, condensation on cold window panes, disappearance of snow or dry ice without melting; expansion of bridges in hot weather, expansion and contraction of balloons with heating and cooling; solid air fresheners.	None

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.CM.e.EB01** Identify common physical changes in matter—size, shape, melting, freezing, dissolving, evaporating. *Key concepts:* States of matter—solid, liquid, gas. Changes in size and shape—bending, tearing, breaking. Processes that cause changes of state—heating, cooling. *Real-world contexts:* Changes in size or shape of familiar objects, such as making snowballs, breaking glass, crumbling cookies, making clay models, carving wood, breaking bones; changes in state of water or other substances, such as freezing of ice cream or ponds, melting wax or steel, puddles drying up; weather conditions; cooking (powdered drink mix).	**S.FI.P.CM.m.EB01** Describe common physical changes in matter: evaporation, condensation, expansion, and contraction. *Key concepts:* Processes that change states of matter—heating, cooling, boiling. *Real-world contexts:* States of matter—solid, liquid, gas. Changes in state, such as water evaporating as clothes dry, condensation on cold window panes, disappearance of snow or dry ice without melting; expansion of bridges in hot weather, expansion and contraction of balloons with heating and cooling; solid air fresheners; weather conditions; hobbies—fishing, melting ice.	n/a
Draft Supported Independence Extended Benchmark Classroom/LEA/ISD	**S.SI.P.CM.e.EB01** Identify changes in states of matter in melting, freezing, boiling, and evaporation. *Key concepts:* Solid, liquid, gas. *Real-world contexts:* Boiling water, ice cream, ice cubes, snow to water.	**S.SI.P.CM.m.EB01** Identify and predict changes in the states of matter in melting, freezing, boiling, and evaporation. *Key concepts:* Solid, liquid, gas, evaporation. *Real-world contexts:* Ice cream in sun, snow in warmth, salt melting ice.	n/a

Draft Participation Extended Benchmark Classroom/LEA/ISD	**S.PA.P.CM.e.EB01** Identify changes in matter in common activities. *Key concepts:* Melting, frozen, cold, hot, warm. *Real-world contexts:* Holding ice cube in hand (melting), ice cream, popsicle.	**S.PA.P.CM.m.EB01** Identify changes in matter in common activities. *Key concepts:* Melting, frozen, cold, hot, warm, solid to liquid. *Real-world contexts:* Holding ice cube in hand (melting), ice cream, popsicle.	n/a
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	**IV.2.e.2** Prepare mixtures and separate them into their component parts. *Key concepts:* Mixture, solution. Separation techniques—(K-2) filtration, using sieves, using magnets, floating vs. sinking; (3-5) dissolving soluble substances, evaporating. *Tools:* Filter paper, funnels, magnets, sieves, beakers, solar stills. *Real-world contexts:* Mixtures of various kinds—salt and pepper, iron filings and sand, sand and sugar, rocks and wood chips, sand and gravel, sugar or salt solutions.	**IV.2.m.2** Describe common chemical changes in terms of properties of reactants and products. *Key concepts:* Common chemical changes—burning, rusting iron, formation of sugars during photosynthesis, acid reacting with metal and other substances. Mass/weight remains constant in closed systems. *Real-world contexts:* Chemical changes—burning, photosynthesis, digestion, corrosion, acid reactions, common household chemical reactions such as with alkaline drain cleaners.	None

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.CM.e.EB02** Prepare mixtures and separate them into their component parts. *Key concepts:* Mixture, solution. Separation techniques—filtration, using sieves, using magnets, floating vs. sinking, dissolving soluble substances, evaporating. *Tools:* Filter paper, funnels, magnets, sieves, beakers. *Real-world contexts:* Common mixtures of various kinds—salt and pepper, sand and sugar, etc.; cooking.	**S.FI.P.CM.m.EB02** Describe common chemical changes in terms of properties of reactants and products. *Key concepts:* Common chemical changes—burning, rusting iron, acid reacting with metal and other substances. *Real-world contexts:* Chemical changes—burning, photosynthesis, digestion, corrosion, acid reactions, common household chemical reactions, such as with alkaline drain cleaners; cooking; automobile care; care of toys and equipment (rain and bicycles).	n/a
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

All students will explain how visible changes in matter are related to atoms and molecules:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	None	**IV.2.m.3** Explain physical changes in terms of the arrangement and motion of atoms and molecules. *Key concepts:* Molecular descriptions of states of matter—see PME-IV.1 m.4. Changes in state of matter—melting, freezing, evaporation, condensation; thermal expansion and contraction (see PCM-IV.2 m.1). Speed of molecular motion— moving faster, slower, vibrate, rotate, unrestricted motion; change in speed of molecular motion with change in temperature. *Real-world contexts:* See examples of physical changes of matter, PCM-IV.2 e.1 and m.1.	**IV.2.h.1** Explain chemical changes in terms of the breaking of bonds and the rearrangement of atoms to form new substances. *Key concepts:* atom, molecule, ion, bond, reactant, product; conservation of mass; rate of reaction—temperature, surface area, concentration; specific chemical reactions—burning paper or wood, rusting iron, formation of sugars during photosynthesis. See PME-IV.1 h.3 (structure of the atom). *Real-world contexts:* Examples of chemical changes—See PCM-IV.2 m.2.
Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	None	None	**IV.2.h.2** Explain why mass is conserved in physical and chemical changes. *Key concepts:* atom, molecule, mass. *Real-world contexts:* Common physical and chemical changes, including matter cycles in ecosystems.
Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	None	None	**IV.2.h.3** Contrast nuclear fission, nuclear fusion, and natural radioactivity. *Key concepts:* Nucleus, nuclear change, force that hold nucleus together, nuclear energy. Stable and unstable isotopes. Properties—mass, element, radioactivity. See PME-IV.1 h.3 (structure of the atom). *Real-world contexts:* Nuclear power plants, nuclear energy from sun, natural radioactive decay, use of radiation and radioactive isotopes in medicine.
Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

All students will explain how changes in matter are related to changes in energy and how living things and human technology change matter and transform energy:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	None	**IV.2.m.4** Describe common energy transformations in everyday situations. *Key concepts:* Forms of energy, including mechanical, heat, sound, light, electrical, magnetic, chemical, food energy. See PME-IV.1 m.5 (electricity in circuits), PCM-IV.2 m.1 (energy in changes of state). Total amount of energy remains constant in all transformations. *Real-world contexts:* Motors, generators, power plants, light bulbs, appliances, cars, radios, TV's, walking, playing a musical instrument, cooking food, batteries, body heat, photosynthesis (see LO-III.2 m.3, LEC-III.5 m.2).	**IV.2.h.4** Describe energy transformations involved in physical, chemical, and nuclear changes, and contrast their relative magnitudes. *Key concepts:* Potential energy, kinetic energy, heat, light, electrical energy, chemical energy, sound; temperature changes. Original sources of energy: sun, radioactivity. Conservation of energy, conservation of mass/energy; E=mc2. See PCM-IV.2 m.4 (common energy transformations), PCM-IV.2 h.3 (nuclear changes). *Real-world contexts:* Common physical, chemical and nuclear changes, including changes of state, burning, electrical decomposition of water, photosynthesis, cellular respiration, fireworks and dynamite, nuclear power, stars.

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	n/a	**S.FI.P.CM.m.EB03** Identify that energy is involved in physical changes. *Key concepts:* Common physical changes—melting, burning, fireworks. *Real-world contexts:* Heat/melting.	**S.FI.P.CM.h.EB01** Identify common energy transformations in everyday situations. *Key concepts:* Forms of energy, including mechanical, heat, sound, light, electrical, magnetic, chemical, food energy. Total amount of energy remains constant in all transformations. *Real-world contexts:* Motors, generators, power plants, light bulbs, appliances, cars, radios, televisions, walking, playing a musical instrument, cooking food, batteries, body heat, photosynthesis.
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	None	None	**IV.2.h.5** Explain changes in matter and energy involving heat transfer. *Key concepts:* Mechanisms of heat transfer —convection, conduction, radiation. Conservation of energy, efficiency. Changes in matter related to heat transfer—changes in temperature, volume, pressure. See PCM-IV.2 m.1 (thermal expansion), EAW-V.3 h.3 (convection). *Real-world contexts:* Convection currents, lake turnover, wind, hot frying pans, heating and cooling buildings, heat lamps, sunlight heating the earth, greenhouse effect, fires for warming.
Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

SCIENCE
STRAND: MOTION OF OBJECTS (MO)

All students will describe how things around us move, explain why things move as they do, and demonstrate and explain how we control the motions of objects:

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.3.e.1** Describe or compare motions of common objects in terms of speed and direction. *Key concepts:* Words—east, west, north, south, right, left, up, down. Speed words—fast, slow, faster, slower. *Real-world contexts:* Motions of familiar objects in two dimensions, including rolling or thrown balls, wheeled vehicles, sliding objects.	**IV.3.m.1** Qualitatively describe and compare motion in two dimensions. *Key concepts:* Two-dimensional motion—up, down, curved path. Speed, direction, change in speed, change in direction. *Real-world contexts:* Objects in motion, such as thrown balls, roller coasters, cars on hills, airplanes.	None
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.MO.e.EB01** Describe motions of common objects in terms of speed and direction. *Key concepts:* Words—east, west, north, south, right, left, up, down. Speed words—fast, slow, faster, slower. *Real-world contexts:* Motions of familiar objects in two dimensions, including rolling or thrown balls, wheeled vehicles, sliding objects; navigating, speed (up hills, down hills).	**S.FI.P.MO.e.EB0B** Compare motions of common objects in terms of speed and direction. *Key concepts:* Relative motion, faster/slower. *Real-world contexts:* Motions of familiar objects in two dimensions, including rolling or thrown balls, wheeled vehicles, sliding objects; navigating, speed (up hills, down hills).	n/a

Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.MO.e.EB01** Recognize movement of objects, including the body. *Key concepts:* Right/left, up/down, fast/slow, faster/slower, push/pull. *Real-world contexts:* Wheelchair, running/walking, leisure activities (rolling and throwing ball, bicycle).	**S.SI.P.MO.m.EB01** Respond accurately to directions of motion. *Key concepts:* Right/left, up/down, fast/slow, faster/slower, push/pull; navigation. *Real-world contexts:* Wheelchair, running/walking, leisure activities (rolling and throwing ball, bicycle); indicating preference (right-/left-handed), direction (turn left/right, stop/go).	n/a
Draft Participation Extended Benchmark Classroom/LEA/ISD and State	**S.PA.P.MO.e.EB01** Identify motions of the body in common activities. *Key concepts:* Up and down, slide, fast/slow, push/pull; how items move; navigation. *Real-world contexts:* Daily living activities (scooter board, wheelchair); leisure activities (rolling ball); mobility; physical therapy.	**S.PA.P.MO.m.EB01** Identify motions of the body in common activities. *Key concepts:* Up and down, slide, fast/slow, push/pull; how items move; navigation. *Real-world contexts:* Daily living activities (scooter board, wheelchair); leisure activities (rolling ball); mobility; physical therapy.	n/a

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.3.e.2** Explain how forces (pushes or pulls) are needed to speed up, slow down, stop, or change the direction of a moving object. *Key concepts:* Changes in motion—speeding up, slowing down, turning. Common forces—push, pull, friction, gravity. Size of change is related to strength of push or pull. *Real-world contexts:* Playing ball, moving chairs, sliding objects.	**IV.3.m.2** Relate motion of objects to unbalanced forces in two dimensions. *Key concepts:* Changes in motion and common forces—speeding up, slowing down, turning, push, pull, friction, gravity, magnets. Constant motion and balanced forces. Additional forces—attraction, repulsion, action/reaction pair (interaction force), buoyant force. Size of change is related to strength of unbalanced force and mass of object. *Real-world contexts:* Changing the direction— changing the direction of a billiard ball, bus turning a corner; changing the speed—car speeding up, a rolling ball slowing down, magnets changing the motion of objects, walking, swimming, jumping, rocket motion, objects resting on a table, tug-of-war.	None

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.MO.e.EB0C** Identify forces (pushes/pulls) that speed up, slow down, stop, or change the direction of a moving object. *Key concepts:* Changes in motion—speeding up, slowing down, turning. Common forces—push, pull, friction, gravity. Size of change is related to strength of push or pull. *Real-world contexts:* Playing ball, moving chairs, sliding objects; sports; motored and non-motored vehicles (bicycle, automobile); accelerating/decelerating.	**S.FI.P.MO.m.EB01** Identify forces (pushes/pulls) that speed up, slow down, stop, or change the direction of a moving object. *Key concepts:* Changes in motion—speeding up, slowing down, turning. Common forces—push, pull, friction, gravity. Size of change is related to strength of push or pull. *Real-world contexts:* Playing ball, moving chairs, sliding objects; sports; motored and non-motored vehicles (bicycle, automobile); accelerating/decelerating.	n/a
Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	n/a	n/a	**S.SI.P.MO.h.EB01** Identify the forces that speed up and slow down motion. *Key concepts:* Right/left, up/down, fast/slow, faster/slower; push/pull; change in speed, gravity, friction; navigation. *Real-world contexts:* Wheelchair, running/walking, leisure activities (rolling and throwing ball, bicycle); indicating preference (right-/left-handed), direction (turn left/right, stop/go); accelerating and decelerating.
Draft Participation Extended Benchmark			

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.3.e.3** Describe patterns of interaction of magnetic materials with other magnetic and non-magnetic materials. *Key concepts:* Magnetic poles, magnetic attraction and repulsion. *Tools:* Magnets, variety of magnetic and nonmagnetic materials (K-2), magnetic compass (3-5). *Real-world contexts:* Common magnets, using a magnetic compass to find direction.	**IV.3.m.3** Describe the non-contact forces exerted by magnets, electrically charged objects, and gravity. *Key concepts:* Electrical charges and magnetic poles—north pole, south pole, positive charge, negative charge; mass, weight, gravitational pull. Charging by rubbing or touching, electric attraction and repulsion. Force depends on size of charges or masses, and decreases quickly with distance. See PMO-IV.3 m.2 (forces and motion), PME-IV.1 m.2 (weight and mass). *Real-world contexts:* Electrically charged or polarized objects, such as balloons rubbed on clothing, bits of paper, salt grains, static cling, magnets, magnetic materials, earth's gravitational pull on objects near its surface, sun's gravitation pull on solar system objects (see ES-V.4 m.2).	None

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.MO.e.EB02** Identify patterns of interaction of magnetic materials with other magnetic and non-magnetic materials. *Key concepts:* Magnetic poles, magnetic attraction and repulsion. *Tools:* Magnets, variety of magnetic and non-magnetic materials, magnetic compass. *Real-world contexts:* Common magnets, using a magnetic compass to find direction.	**S.FI.P.MO.m.EB02** Describe patterns of interaction of magnetic materials with other magnetic and non-magnetic materials. *Key concepts:* Magnetic poles, magnetic attraction and repulsion. *Tools:* Magnets, variety of magnetic and non-magnetic materials, magnetic compass. *Real-world contexts:* Common magnets, using a magnetic compass to find direction.	**S.FI.P.MO.h.EB01** Describe the non-contact forces exerted by magnets, electrically charged objects, and gravity. *Key concepts:* Repel/attract. *Real-world contexts:* Electrically charged or polarized objects, such as balloons rubbed on clothing, bits of paper, salt grains, static cling, magnets, magnetic materials, earth's gravitational pull on objects near its surface, sun's gravitation pull on solar system objects; building trades (stud finders, screwdrivers); common household repairs; use of navigational compass.
Draft Supported Independence Extended Benchmark Classroom/LEA/ISD	**S.SI.P.MO.e.EB02** Explore activities using magnetic and non-magnetic materials. *Key concepts:* Magnetic push/pull. *Real-world contexts:* Exploring during play; refrigerator.	**S.SI.P.MO.m.EB02** Explore the uses of magnetic objects. *Key concepts:* What magnets attract or repel. *Real-world contexts:* Refrigerator, screwdriver.	**S.SI.P.MO.h.EB02** Identify and use practical magnetic objects and tools. *Key concepts:* Positive/negative. *Real-world contexts:* Screwdriver, compass, roller coaster, magnet storage (not by credit cards, disks, computers), medical safety.
Draft Participation Extended Benchmark Classroom/LEA/ISD	**S.PA.P.MO.e.EB02** Explore activities using magnetic and non-magnetic materials. *Key concepts:* Magnetic push/pull. *Real-world contexts:* Exploring during play; refrigerator, letter board, games.	**S.PA.P.MO.m.EB02** Explore activities using magnetic and non-magnetic materials. *Key concepts:* Magnetic push/pull. *Real-world contexts:* Exploring during play; refrigerator, letter board, games.	**S.PA.P.MO.h.EB02** Identify activities using magnetic and non-magnetic materials. *Key concepts:* Magnetic push/pull. *Real-world contexts:* Exploring during play; letter board, games.

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	None	**IV.3.m.4** Use electric currents to create magnetic fields, and explain applications of this principle. *Key concepts:* Electric current, magnetic poles, magnetic fields. (See PME-IV.1 m.5, electric circuits.) *Tools:* Magnetic compass, battery, wire. *Real-world contexts:* Electromagnets, bells, speakers, motors, magnetic switches, Earth's magnetic field.	None
Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.3.e.4** Identify and use simple machines and describe how they change effort. *Key concepts:* Inclined planes, levers, pulleys, wedges, wheel and axle; force, distance. *Real-world contexts:* Block and tackles, ramps, screwdrivers and screws, can openers, see-saws.	**IV.3.m.5** Design strategies for moving objects by application of forces, including the use of simple machines. *Key concepts:* Types of simple machines—lever, pulley, screw, inclined plane, wedge, wheel and axle, gear; direction change, force advantage, speed and distance advantage. *Real-world contexts:* Objects being moved by using simple machines, such as wagons on inclined planes, heavy objects moved by levers, seesaw, cutting with knives or axes.	**IV.3.h.1** Analyze patterns of force and motion in the operation of complex machines. *Key concepts:* Electrical and/or mechanical components of complex machines. *Real-world contexts:* Machines, such as bicycles, automobiles, pumps, electrical motors.
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.MO.e.EB03** Identify and use simple machines to change effort. *Key concepts:* Inclined planes, levers, pulleys, wedges, wheel and axle; force, distance. *Real-world contexts:* Blocks and tackles, ramps, screwdrivers and screws, can openers, seesaws.	**S.FI.P.MO.m.EB0A** Identify which simple machine is best used in a given situation. *Key concepts:* Types of simple machines. *Real-world contexts:* Blocks and tackles; screwdrivers and screws; can openers; objects being moved by using simple machines, such as wagons on inclined planes; heavy objects moved by levers; seesaw; cutting with knives or axes; building trades.	**S.FI.P.MO.h.EB02** Identify patterns of force and motion in the operation of complex machines. *Key concepts:* Common complex machines, such as bicycles and wheelchairs. *Real-world contexts:* Riding a bicycle.

Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.MO.e.EB03** Recognize simple machines used to change effort. *Key concepts:* Lifts, ramps, wheels, wedges (for position). *Real-world contexts:* Faucets, paper towel machine.	**S.SI.P.MO.m.EB03** Identify simple machines used to change effort. *Key concepts:* Levers, wheels and axles, wedges (for position), gears, pulley. *Real-world contexts:* Door handle, bicycle, wheelchair, cart, can opener, door gears; repairing.	**S.SI.P.MO.h.EB03** Identify simple machines used to change effort. *Key concepts:* Levers, wheels and axles, wedges (for position), gears, pulley. *Real-world contexts:* Door handle, bicycle, wheelchair, cart, can opener, door gears; repairing.
Draft Participation Extended Benchmark Classroom/LEA/ISD and State	**S.PA.P.MO.e.EB03** Identify simple machines in activities that change effort. *Key concepts:* Lifts, ramps, wheels, wedges (for position). *Real-world contexts:* Faucets, paper towel machine.	**S.PA.P.MO.m.EB03** Identify simple machines in activities that change effort. *Key concepts:* Lifts, ramps, wheels, wedges (for position). *Real-world contexts:* Faucets, paper towel machine.	**S.PA.P.MO.h.EB03** Identify simple machines in activities that change effort. *Key concepts:* Lifts, ramps, wheels, wedges (for position). *Real-world contexts:* Faucets, paper towel machine.
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	**IV.3.e.5** Manipulate simple mechanical devices and explain how their parts work together. *Key concepts:* Names and uses for parts of machines, such as levers, wheel and axles, pulleys, inclined planes, gears, screws, wedges. *Real-world contexts:* Simple mechanical devices, such as bicycles, bicycle pumps, pulleys, faucets, clothespins, can openers.	None	None

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	n/a	**S.FI.P.MO.m.EB03** Manipulate simple mechanical devices and explain how their parts work together. *Key concepts:* Names and uses for parts of machines, such as levers, wheel and axles, pulleys, inclined planes, gears, screws, wedges. *Real-world contexts:* Simple mechanical devices, such as bicycles, bicycle pumps, pulleys, faucets, clothespins, can openers; cooking; laundry; household repairs.	n/a
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

All students will relate motion to energy and energy conversions:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	None	None	**IV.3.h.2** Explain energy conversions in moving objects and machines. *Key concepts:* Types of energy—electrical energy, kinetic energy, gravitational potential energy, potential energy in springs, chemical potential energy, heat energy, radiation. Energy transformations—see PCM-IV.2 m.4. Efficiency. See PME-IV.1 h.4 (conservation of energy) and PCMIV.2 h.4 (energy in physical and chemical changes). *Real-world contexts:* Simple and complex machines, roller coasters, swings, pendulums, elevators, automobiles, fans, motors.
Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

SCIENCE
STRAND: WAVES AND VIBRATIONS (WV)

All students will describe sounds and sound waves:

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.4.e.1** Describe sounds in terms of their properties. *Key concepts:* Properties: pitch—high, low. Loudness—loud, soft. *Real-world contexts:* Sound from common sources, such as musical instruments, radio, television, animal sounds, thunder, human voices.	**IV.4.m.1** Explain how sound travels through different media. *Key concepts:* Media—solids, liquids, gases. Vacuum. *Real-world contexts:* Sounds traveling through solids, such as glass windows, strings, the earth; sound traveling through liquids, such as dolphin and whale communication; sound traveling through gases, such as human hearing, sonic booms.	**IV.4.h.1** Relate characteristics of sounds that we hear to properties of sound waves. *Key concepts:* Properties of sounds—pitch, volume. Characteristics of sound waves—frequency, amplitude, velocity. *Real-world contexts:* Common sounds that vary in pitch and volume—see PWV-IV.4 e.1.
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.WV.e.EB01** Describe sounds in terms of their properties. *Key concepts:* Properties: pitch—high, low; loudness—loud, soft. *Real-world contexts:* Sound from common sources, such as musical instruments, radio, television, animal sounds, thunder, human voices; hobbies—music, television; explaining weather; explaining communication.	**S.FI.P.WV.m.EB01** Recognize how sounds travel through different media. *Key concepts:* Media—solids, liquids, gases. *Real-world contexts:* Sounds traveling through solids, such as glass windows, strings, the earth; sound traveling through liquids, such as dolphin and whale communication; sound traveling through gases, such as human hearing, sonic booms; health—hearing.	**S.FI.P.WV.h.EB01** Recognize how sounds travel through different media. *Key concepts:* Media—solids, liquids, gases. *Real-world contexts:* Sounds traveling through solids, such as glass windows, strings, the earth; sound traveling through liquids, such as dolphin and whale communication; sound traveling through gases, such as human hearing, sonic booms; health—hearing.

Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.WV.e.EB01** Identify and create sounds. *Key concepts:* Loud/soft, high/low. *Real-world contexts:* Leisure activities (music—playing instrument, clapping, snapping); objects in environment (safety alarms, telephone); animals; communication.	**S.SI.P.WV.m.EB01** Compare properties of sound. *Key concepts:* Loud/soft, high/low. *Real-world contexts:* Leisure activities (music—playing instrument, clapping, snapping); objects in environment (safety alarms, telephone); animals; communication.	**S.SI.P.WV.h.EB01** Identify vibration as the source of sound. *Key concepts:* Loud/soft, high/low, vibration. *Real-world contexts:* Leisure activities (music—playing instrument, guitar, drumming, clapping, snapping); objects in environment (safety alarms, telephone); animals; communication (vocal cords).
Draft Participation Extended Benchmark Classroom/LEA/ISD and State	**S.PA.P.WV.e.EB01** Identify different characteristics of sound. *Key concepts:* Vibration, loud/soft, high/low. *Real-world contexts:* Leisure activities (music—playing instrument, clapping, snapping); objects in environment—safety alarms, telephone.	**S.PA.P.WV.m.EB01** Identify ways to create sound. *Key concepts:* Vibration, switch devices. *Real-world contexts:* Leisure activities (music—playing instrument, clapping, snapping); objects in environment—safety alarms, telephone; communication.	**S.PA.P.WV.h.EB01** Identify sources of sound. *Key concepts:* Vibration, loud/soft, high/low. *Real-world contexts:* Water running, fire siren, thunder, animals, communication.

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.4.e.2** Explain how sounds are made. *Key concepts:* Vibrations—fast, slow, large, small. *Real-world contexts:* Sounds from common sources, such as musical instruments, radio, television, animal sounds, thunder, human voices.	**IV.4.m.2** Explain how echoes occur and how they are used. *Key concepts:* Echo, sonar, reflection. *Real-world contexts:* Echoes in rooms—acoustics—and outdoors; practical uses of echoes, such as navigation by bats and dolphins, ultrasound imaging, sonar.	None
Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.WV.e.EB0E** Explain how sounds are made. *Key concepts:* Vibrations—fast, slow, large, small. *Real-world contexts:* Sounds from common sources, such as musical instruments, radio, television, animal sounds, thunder, human voices; hobbies—music, television; weather; speech and communication.	**S.FI.P.WV.m.EB01** Identify echoes and how they are used. *Key concepts:* Echo, sonar, reflection. *Real-world contexts:* Echoes in rooms—acoustics—and outdoors; practical uses of echoes, such as navigation by bats and dolphins, ultrasound imaging, sonar.	n/a
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

All students will explain shadows, color, and other light phenomena:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	**IV.4.e.3** Use prisms and filters with light sources to produce various colors of light. *Key Concepts:* White light is composed of different colors. *Tools:* Prisms, color filters, colored lights. *Real-world contexts:* Light from common sources, such as sun, stars, light bulb, colored lights, firefly, candle, flashlight, various prisms.	**IV.4.m.3** Explain how light is required to see objects. *Key concepts:* Light source, object, eye as a detector, illumination, path of light, reflection, absorption. See PWV-IV.4 m.2 (echo location). *Real-world contexts:* Seeing common objects in our environment; seeing "through" transparent media, such as windows, water; using flashlights to see in the dark.	**IV.4.h.2** Explain how we see colors of objects. *Key concepts:* Characteristics of light—brightness, amplitude, colors of spectrum (red, orange, yellow, green, blue, indigo, violet) wavelength, frequency (see PWV-IV.4 h.3). Ways that objects interact with light—emission, reflection, absorption, transmission, scattering (see PWV-IV.4 m.4). *Real-world contexts:* Colored light-reflecting objects, such as books, clothes, color photographs; colored light-transmitting objects, such as stained glass, cellophane; colored light-emitting objects, such as television, neon lights. Scattering of light by the atmosphere.

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.WV.e.EB02** Use prisms and filters with light sources to produce various colors of light. *Key concepts:* White light is composed of different colors. *Tools:* Prisms, color filters, colored lights. *Real-world contexts:* Light from common sources, such as sun, stars, light bulb, colored lights, firefly, candle, flashlight, various prisms.	**S.FI.P.WV.m.EB02** Explain how light is required to see objects. *Key concepts:* Light source, object, eye as a detector, illumination, path of light, reflection, absorption. *Real-world contexts:* Seeing common objects in our environment; seeing "through" transparent media, such as windows, water; using flashlight to see in the dark; using flashlight with mirrors; light source and different colors of paper (absorption); glossy medium and reflection of light; clothing choice (light shirt/hot day); safety practices.	n/a
Draft Supported Independence Extended Benchmark Classroom/LEA/ISD and State	**S.SI.P.WV.e.EB02** Identify light sources. *Key concepts:* Light source, shadows, colors. *Real-world contexts:* Safety issues; toys, flashlight, light fire, stars, colored paper, mirror.	**S.SI.P.WV.m.EB02** Identify light sources. *Key concepts:* Light source, shadows, colors. *Real-world contexts:* Safety issues; flashlight, light bulb, fire, sun, stars.	n/a
Draft Participation Extended Benchmark Classroom/LEA/ISD and State	**S.PA.P.WV.e.EB02** Identify light sources in common activities. *Key concepts:* Light sources. *Real-world contexts:* Shade, sunglasses, hat, colored paper, mirror, prism.	**S.PA.P.WV.m.EB02** Identify light sources in common activities. *Key concepts:* Light sources. *Real-world contexts:* Shade, sunglasses, hat, toys, flashlight, lamp.	n/a

	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	**IV.4.e.4** Explain how shadows are made. *Key concepts:* Shadow, blocked path, surface, object, light moves outward from source in straight lines. *Real-world contexts:* Shadows made on surfaces by putting objects in the path of light from common sources, including sunlight, light bulbs, projectors. Changes in size of shadows due to distance from object.	**IV.4.m.4** Describe ways in which light interacts with matter. *Key concepts:* Reflection, refraction, absorption, transmission, scattering, medium, lens. Transmission of light—transparent, translucent, opaque. *Real-world contexts:* Objects that reflect or absorb light, including mirrors; media that transmit light such as clear and frosted glass, clear and cloudy water, clear and smoky air; objects that refract light, including lenses, prisms, and fiber optics; uses of lenses, such as eye, cameras, telescope, microscope, magnifying lens, for magnification and light-gathering.	None

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	**S.FI.P.WV.e.EB03** Explain how shadows are made. *Key concepts:* Shadow, blocked path, surface, object, light moves outward form source in straight lines. *Real-world contexts:* Shadows made on surfaces by putting objects in the path of light from common sources, including sunlight, light bulb, projectors; changes in size of shadows due to distance form object.	**S.FI.P.WV.m.EB03** Identify applications of shadows in real-world contexts. *Key concepts:* Shadow, blocked path, surface, object. *Real-world contexts:* Protection from sun and sunburns; horticulture—plant shade trees covering sun's path for cooling.	**S.FI.P.WV.h.EB02** Describe ways in which light interacts with matter. *Key concepts:* Reflection, refraction, absorption, scattering, medium, lens. *Real-world contexts:* Objects that reflect or absorb light, including mirrors; media that transmit light, such as clear and frosted glass, clear and cloudy water, clear and smoky air; objects that refract light, including lenses, prisms, and fiber optics; uses of lenses, such as eye, cameras, telescope, microscope, magnifying lens, for magnification and light-gathering.
Draft Supported Independence Extended Benchmark Classroom/LEA/ISD	**S.SI.P.WV.e.EB03** Identify refection in common activities. *Key concepts:* Reflection. *Real-world contexts:* Exploring with mirrors; hygiene (dressing, self care, checking appearance).	**S.SI.P.WV.m.EB03** Identify shadows and sources of reflection. *Key concepts:* Reflection, shade, shadow, protection from sun. *Real-world contexts:* Useful and harmful reflections—protection from sun and sunburns; shade trees, hat, umbrella, sunglasses, blinds.	**S.SI.P.WV.h.EB02** Use light and blockages to create shadows. *Key concepts:* Reflection, shade, shadow, protection from sun. *Real-world contexts:* Useful and harmful reflections—protection from sun and sunburns; shade trees, hat, umbrella, sunglasses, blinds.

Draft Participation Extended Benchmark Classroom/LEA/ISD	**S.PA.P.WV.e.EB03** Demonstrate an awareness of reflections. *Key concepts:* Mirrors. *Real-world contexts:* Exploring with mirrors; hygiene (self care, dressing, checking appearance).	**S.PA.P.WV.m.EB03** Identify examples of reflections. *Key concepts:* Mirrors. *Real-world contexts:* Exploring with mirrors; useful/harmful reflections—protection from sun and sunburns; hygiene (self care, dressing, checking appearance).	**S.PA.P.WV.h.EB03** Identify examples of reflections. *Key concepts:* Mirrors. *Real-world contexts:* Exploring with mirrors; useful/harmful reflections—protection from sun and sunburns; hygiene (self care, dressing, checking appearance).
All students will measure and describe vibrations and waves:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	None	**IV.4.m.5** Describe the motion of vibrating objects. *Key concepts:* Period, frequency, amplitude. *Real-world contexts:* Vibrating or oscillating objects, such as weights on springs, vocal cords, tuning forks, guitar strings.	**IV.4.h.3** Describe waves in terms of their properties. *Key concepts:* Mechanical waves, electromagnetic waves—see PWV-IV.4 h.4. Colors of light. Properties of waves—frequency, amplitude, wavelength, wave velocity, energy. Units of measurement—hertz or cycles per second, micrometers, meters, meters per second. *Tools for making spectra:* Prism, diffraction grating. *Real-world contexts:* Examples of mechanical and electromagnetic waves—see PWV-IV.4 h.4. Colors of light, frequencies of radio and TV transmission.

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD and State	n/a	n/a	**S.FI.P.WV.h.EB03** Identify properties of waves. *Key concepts:* Period, frequency, amplitude. *Real-world contexts:* Vibrating or oscillating objects, such as weights on springs, vocal cords, tuning forks, guitar strings.
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	Elementary School	Middle School	High School
Science Benchmark MCF v.2000	None	None	**IV.4.h.4** Describe different types of waves and their technological applications. *Key concepts:* Types of waves—mechanical: sound, ultrasound, water waves, shock wave; electromagnetic: radio waves, microwaves, radiant heat, infrared radiation, visible light, ultraviolet radiation, x-rays. Properties of waves—see PWVIV.4 h.3. See PCM-IV.2 m.4 (energy transformations). *Real-world contexts:* Examples of mechanical waves—sound, ultrasound, ocean waves, wave tanks, earthquakes, seismic waves; examples of electromagnetic waves, such as light—see above, radio and television signals, heat lamps, microwave transmitters, radar, ultraviolet radiation in sunlight, X-ray machines, CAT-scans, gamma rays from radioactive decay.

Draft Functional Independence Extended Benchmark Classroom/LEA/ISD	n/a	n/a	**S.FI.P.WV.h.EB0F** Identify different types of waves. *Key concepts:* Types of waves—mechanical: sound, ultrasound, water waves, shock wave; electromagnetic: radio waves, microwaves, radiant heat, infrared radiation, visible light, ultraviolet radiation, x-rays. Properties of waves. *Real-world contexts:* Examples of mechanical waves—sound, ultrasound, ocean waves, wave tanks, earthquakes, seismic waves; examples of electromagnetic waves, such as light—see above, radio and television signals, heat lamps, microwaves transmitters, radar, ultraviolet radiation in sunlight, x-ray machines, CAT-scans; medical technicians; current events.
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			

All students will explain how waves and vibrations transfer energy:			
	Elementary School	**Middle School**	**High School**
Science Benchmark MCF v.2000	None	**IV.4.m.6** Explain how mechanical waves transfer energy. *Key concepts:* Sound energy, absorption, transmission, reflection; media—air, solids, water. (See PME-IV.1 m.6, electrical circuits transfer electrical energy.) *Real-world contexts:* Waves in slinkies and long springs, sound waves, water waves, earthquakes.	None
Draft Functional Independence Extended Benchmark			
Draft Supported Independence Extended Benchmark			
Draft Participation Extended Benchmark			